Cross-national heterogeneity in e-retail spending: a longitudinal analysis of economic, technological and political forces

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Abstract

Purpose: *This paper examines the technological, market, industry and institutional sources associated with the cross-national heterogeneity in e-retail spending.*

Design/methodology/approach: *We used time series cross sectional (TSCS) models linear in parameters for 10 year data from 43 countries to test our hypotheses.*

Findings: *We found that how broadband Internet is accessed, identified as an important determinant of an economy's "e-readiness", explains international heterogeneity in e-retail spending. We also found various specific attributes of the traditional retail environment that produce enhancing effects as well as suppressing effects for e-retail spending. Finally, we also found regulatory forces' impacts on the development of the e-retail industry.*

Research limitations/implications: *Due to the unavailability of reputable data, we could not include many economies at the bottommost of the global economic pyramid.*

Originality/value: *To our knowledge, this is the first study focusing on cross-national heterogeneity in e-retailing in a range of economies. We used the economic theory of complementarities as the theoretical framework. We identified various activities and resources in the e-retail ecosystems that may produce positive and negative synergies in the development of the e-retail industry.*

Keywords: *E-retailing, economic theory of complementarities, externality mechanisms, panel data models, economic freedom, broadband penetration*

1. Introduction

Economies worldwide differ greatly in the development of the e-retail industry. For instance, according to Euromonitor International, per capita e-retail spending in 2008 varied from US\$ 0.30 in India to US\$ 474 in the United Kingdom (see Table 1). While prior research has shown that household income is an important factor affecting online spending (Stranahan and Kosiel 2007), cross country variability in income does not seem to explain a large proportion of the variability in e-retail spending. For instance, Japan's per capita income is almost double that of South Korea. However, Euromonitor data indicate that Japan's per capita e-retail spending in 2007 was less than half that of South Korea. Likewise, the Pearsonian coefficient of correlation between per capita spending in store-based retailing and e-retailing for 2007 is 0.559. This implies that store-based retail spending explains only 31.2% of variance in e-retail spending in the cross national setting. Ostensibly, factors other than conventional retail spending explain a large proportion of the cross-country variance in e-retailing.

E-retailing has been widely heralded as an important innovation in the retail industry. An understanding of its diffusion and adoption requires a careful theoretical analysis of technological, market, industry and institutional processes. Drawing on the analysis of Schumpeter (1939), Antonelli (2009) points out that an analysis of “the collective character of the innovation process, the interdependence among innovators, and the complementarity of the new technologies within the gales of innovations”, and the “intertwined co-evolution of economic institutions, industrial structures, economic architectures of interactions and exchanges and consumers' preferences along with the innovative process” would offer important insight into the “systemic and inherently complex character of the innovation dynamics” (p. 621).

Table 1: Per capita e-retail spending in economies used in this study.

Economy	Per capita e-retail spending (US\$, 1999)	Per capita e-retail spending (US\$, 2008)	Economy	Per capita e-retail spending (US\$, 1999)	Per capita e-retail spending (US\$, 2008)
Argentina	0.1	11.5	Netherlands	11.1	154.4
Australia	16.2	91.5	New Zealand	12.4	55
Austria	30.7	84.6	Norway	37.3	222
Belgium	18.1	118.6	Philippines	1.7	2.3
Brazil	1.8	22.6	Poland	1	34.5
Bulgaria	0	3.3	Portugal	1	24
Canada	25.4	63.7	Romania	0	8.3
China	0	1	Russia	0.3	26.9
Czech Republic	1.5	69.9	Singapore	6.6	83.6
Denmark	4.7	241	Slovakia	1.2	17.1
Finland	71	273.6	South Africa	1.2	11.9
France	9	161.5	South Korea	19.2	315.8
Germany	15.9	162.5	Spain	5	63.9
Greece	2.8	38.6	Sweden	11.7	229.9
Hong Kong	2.2	60.2	Switzerland	24.3	165.3
Hungary	0.2	12.1	Taiwan	17.4	72.8
India	0	0.3	Thailand	1.8	4.5
Israel	13	27.4	Turkey	6.5	11.9
Italy	2.5	34.7	United Kingdom	25.2	473.7
Japan	28.4	159.1	USA	58.1	302.3
Malaysia	2.8	37.7	Venezuela	0.4	9.1
Mexico	1.5	6.1			

Source: Authors' calculation based on data from Euromonitor International

As to the innovation process, broadband Internet access has served as an important catalyst for improving the digital economy and is identified as an important determinant of an economy's "e-readiness" (ebusinessforum.com, 2005). Broadband definitely holds a promise of extraordinary progress in the development of the e-retail industry. For instance, businesses are

exploring the possibilities of three-dimensional (3D) e-retailing, where consumers can "walk" the aisles of supermarkets, interact with experts and find items that are unavailable in the local store (Cleverley, 2009). However, a high degree of e-readiness does not necessarily translate into a high degree of development of the e-retail industry. While there are some anecdotes and indirect evidence regarding the impact of broadband on e-retailing, there have been few serious academic studies on the topic and little attempt has been made to develop conceptual frameworks for evaluating the broadband penetration-e-retailing nexus. Moreover, most of these assertions and observations are based on single country studies. In this paper we would argue that e-retail environments are different across countries and that what may be valid in single country research may not be so in cross-national comparisons.

Although broadband Internet access seems to be related to e-retail spending, the relationship is far from perfect, as is evidenced by a comparison of these two variables across a range of economies used in our analysis. For instance, in 1999, the U.S. had the second highest per capita e-retail expenditure (after Finland) among the 43 economies analyzed in this paper. However, 17 of them had a higher broadband penetration than in the U.S. This raises a second and even more intriguing issue. Various resources and activities inside and outside the retail sector may enhance or suppress the effect of broadband on consumers' ability and willingness to engage in e-retail activities.

In a broad sense these mechanisms can be looked at as representing the influence of complementary resources, which may produce positive as well as negative synergies through compensatory, enhancing or suppressing effects (Wade and Hulland, 2004). Prior research suggests that the marketplace selects "new and better technologies, often characterized by strong

systemic complementarities” (Antonelli 2009; p. 625). All of this raises an interesting question for scholars: what are the complementary activities and resources associated with e-retailing?

The emergence of e-retailing has allowed consumers to locate and purchase products which would not be possible in the absence of such a channel due to high transaction costs and/or low product awareness. E-retailing thus has a potential to enhance consumer welfare. E-retailers can ensure the availability of a greater variety of products. Features such as product recommendation systems and cataloging are unique to e-retailing, which help to lower transaction costs and increase product awareness (Brynjolfsson et al., 2003).

The research objective of this paper is modest yet salient: given the various forces affecting the development of e-retailing, we investigate theoretically and empirically how technological, market, industry and policy issues are linked to cross-national heterogeneity in e-retail spending. While we refer to a wide range of studies facilitating and hindering the diffusion and adoption of e-retailing, we recognize that our main focus and contribution are to economic theory of complementarities within the e-retailing environment.

In the remainder of the paper is organized as follows. We first provide a literature review and develop some hypotheses on cross-national variation in e-retail spending. Next, we discuss our methods. It is followed by a section on the results. Then, we provide discussion and implications of our study. The paper concludes with some comments on limitations and further research.

2. Literature Review

In a small but growing body of theory and empirical research, scholars have addressed the topic of cross-national variation in e-commerce activities from different perspectives. Table 2 summarizes representative empirical studies, showing that researchers have studied the effects of

various environmental and contextual factors at different levels of analysis (e.g., firm, individual and national) while adopting multiple methodologies and approaches.

Table 2: A review of cross-country e-commerce studies.

Study	Dependent variable(s)	Major explanatory variables examined	Method	No. of countries	Level of analysis
Oxley and Yeung (2001)	Internet users per capita (1998) Internet hosts per capita (1998)	Rule of law, availability of payment channels	OLS	25-30	Country
Zhu et al. (2003)	E-business adoption	Technology competence, firm scope/size, consumer readiness, competitive pressure, trading partner readiness.	Logit models	8 (European countries)	Firm/individual
Gibbs et al. (2003)	B2B and B2C e-commerce adoption	Consumer preferences and values, national culture, distribution systems, global competition, e-commerce legislation	Case studies	10	Firm
Mahmood et al. (2004)	On-line shopping behavior	Trust and economic conditions, educational level and technology savviness	Structural equation models	26	Individual
Xu et al. (2004)	Adoption of e-business-related technologies (mainly inter-organizational)	Government regulation, technology competence, enterprise integration, competition intensity	Structural equation models	2 (U. S. and China)	Firm
Zhu and Kraemer (2005)	E-business use and value	Technology competence, firm size, financial commitment, competitive pressure, and regulatory support	Structural equation models	10	Firm
Ho et al. (2007)	Per capita online shopping expenditures (2000-2004)	No. of Internet users, capital investment in telecommunications, credit card penetration, venture capital availability, level of education	OLS and GLS	15 (European countries)	Country
Zhao (2011)	E-government development	Hofstede's cultural dimension	Multiple regression	84	Country

While these studies significantly improved our understanding of international heterogeneity in e-commerce activities, several gaps can be identified in the literature. Prior

research studies have emphasized the importance of studying width and depth of adoption of an innovation rather than merely focusing on the adoption decision (Gatignon and Robertson, 1985). Following Gatignon and Robertson, the width of e-commerce adoption can be defined as the number of different uses of e-commerce technology by an individual or a firm. Similarly, the depth of e-commerce adoption can be defined as the amount of usage of the e-commerce technology (e.g., e-commerce revenue or spending). The depth of adoption may warrant elaboration. Dholakia, Dholakia and Kshetri (2004) have introduced the concept of overall depth, which is related to the total usage of the technology and functional depth, which, in turn, is related to the usage of the technology for performing a particular function (e.g., the use of the Internet in retailing). To put things in context, e-retail spending can be considered as a measure of a functional depth of e-commerce adoption. Although there has been a growing interest in the information system and e-commerce literature on cross-national e-commerce adoption and diffusion research, there is a relative scarcity of research on width and depth of e-commerce adoption.

Second, most cross-national e-commerce studies focus on a small number of countries and thus lack representativeness and generalizability. For instance, very few studies have included more than twenty countries in their research (see Table 2). Moreover most studies on this topic have included only industrialized countries.

Third, most cross-national e-commerce studies are cross sectional in nature. Prior research has noted the important role of analyzing longitudinal processes associated with e-commerce adoption (Zhu and Kraemer, 2005). Only a fairly long-term, longitudinal study can illuminate the changing influence of various environmental and contextual factors on

individuals' and firms' e-commerce behaviors and whether such behaviors are sustained over time (Zhu and Kraemer, 2005).

Sharma and Hao (2012) cite significant evidence of a direct, causal relationship between the adoption of information technologies and national economic growth. Prior research has also suggested that careful attention must be paid to economic and institutional factors that facilitate or hinder technology diffusion across countries (Oxley and Yeung, 2001). There seems to be a two-way path. This paper attempts to address these issues by empirically examining the sources of cross-national heterogeneity in e-retail spending. As noted earlier, our framework mainly builds on economic theory of complementarities.

The central premise of economic theory of complementarities is that additive synergies are created by a complementary set of resources (Barua and Whinston, 1998). Across multiple levels of analysis, researchers have examined how various resources produce complementary effects with investments and advancements in IT. First, one stream of research has suggested that the impact of IT does not materialize by itself; instead, it is the synergistic combination of IT and complementary organizational investments that creates positive organizational effects (Zhu and Kraemer, 2002; Xia and Zhang, 2010). King, Covin, and Hegarty (2003) have also found that resources of small and large firms are linked to industry-level phenomena surrounding technological change.

Wade and Hulland (2004) have noted three mechanisms associated with the influence of complementary resources. These resources may produce positive as well as negative synergies. First, compensatory effects entail offsetting of positive change in one type of resource by a negative change in the other. Second, enhancing effects occur if the effect of one resource is

magnified or amplified by the presence of the other. Finally, in suppressing effects, the presence of one resource leads to a decline in the impact of the other.

3. Drivers of e-retail spending: a framework and some hypotheses

The framework proposed in this paper comprises of investigating e-retail spending as the dependent variable and the following as explanatory variables: i) broadband penetration, ii) propensity to spend, iii) traditional substitutes, and iv) economic freedom. The interaction or control variable is the per capita GDP.

Figure 1: The Conceptual Framework for Drivers of E-Retail Spending.

Figure 1 illustrates the conceptual framework proposed in this paper. As noted in the literature review, there is considerable agreement in the literature that both technology and economic factors contribute to the up-take of mobile and Internet services. This framework focusses on macro-economic variables. For example, Sharma et al. (2012) found that electronic Word-of-

Mouth is a key influencer of Internet-related behaviour but such a variable is out-of-scope. In the remainder of this section, the explanatory variables are described and hypotheses derived.

3.1 Broadband penetration

In prior theoretical and empirical research, scholars have viewed the availability of well-developed ICT infrastructures as an important variable explaining cross-national variation in e-commerce activities (Gibbs et al., 2003; Ho et al., 2007; Oxley and Yeung, 2001). It has also been observed that the international digital divide has shifted from basic to advanced communications and more generally from quantity to quality (World Telecommunication Development Report, 2002). A study of Pew Research, for instance, indicated that dial-up and high-speed Internet connections differ in terms of their impact on e-retailing standpoint. A 2004 Pew study on online banking indicated that during 2002-2004, the adoption of online banking increased from 24% to 35% for dial-up users, compared to 35% to 63% for broadband users (cf. Sciglimpaglia and Ely, 2006). Consumers with broadband access are also likely to make more purchases online. One study suggested that broadband users spent 20% more online than their dial-up counterparts (O'Rourke, 2000). Cheap broadband connection has facilitated China's e-retail industry even in rural areas (Economist 2011). E-retail activities' shift towards cloud computing environment even increases the importance of broadband (Biederman, 2012; Kshetri 2010, 2011).

It is argued that broadband capability is an important driver of e-retailing (Johnsen, 2007; MarketWatch: Global Round-up, 2007). Why might this be the case? An extensive body of literature indicates the importance of retail buyers' perceived convenience to the success of e-retailing (Hemp, 2006; Sherwood, 2007; Spiller and Lohse, 1998; Szymanski and Hise, 2000). Broadband offers convenience, ease of use and other benefits. To attract consumers, e-retailers

need to provide “ambience-enhancers” such as video streaming and music (Allred et al., 2006: 330), which involve bandwidth intensive applications. A number of single-country surveys have confirmed the impact of broadband on the growth of the e-retailing industry. A survey of 3,000 U.K. consumers surveyed by Verdict Research indicated that two thirds of them had broadband access, who reported that broadband influenced them to shop online more frequently (MarketWatch: Global Round-up, 2007).

As noted earlier, 3D e-retailing allows consumers to interact with experts and find items that are unavailable in the local store (Cleverley, 2009). The 3D Web space thus provides experience that would be difficult to replicate in conventional retailing (Hemp, 2006). Lands' End's Swim Finder feature introduced in 2005 provides a case in point. The 3D feature allows women to choose swimsuits that "enhance or de-emphasize" certain body parts (LNWWJ, 2005). These e-retailers, for example, offer features such as message boards and the ability to review products and allow groups of people to interact with one another, some of them in a three-dimensional Web space (Hemp, 2006; Sherwood, 2007). In order to attract customer attention, e-retailers use features such as 2D or 3D animation, voice, video, graphics, music and other multimedia (Ranganathan and Ganapathy, 2002). In sum, broadband enables consumers to benefit from the potential of e-retailing. Thus the following hypothesis is derived for further analysis:

H₁: Ceteris paribus, the per capita e-retail spending in an economy is positively related to broadband penetration.

3.2 Consumers' propensity to spend on store-based retailing

We begin this section by stating that consumers' preferences as well as economic architectures of interactions and exchanges affect the development of the retail industry and the effects of innovations on this industry (Schumpeter, 1939, Antonelli, 2009). It has been noted that

consumers save part of their disposable income and invest in various assets. The remaining part of the income is spent on retail goods as well as on the demand of non-retail goods such as entertainment, educational opportunities, health services, and housing.

A high level of spending in store-based retail activities may indicate the existence of factors that produce complementarity and synergy effects, which lead to a high propensity to spend on e-retailing. For instance, demographic characteristics such as the proportion of affluent households and families with children, businesses' innovative pricing and promotions strategies competitive environment and availability of credit, produce a climate that is favorable for store-based retail as well as e-retail activities. This can also be explained in terms of enhancing effects, which occur if the effect of one resource is magnified or amplified by the presence of the other (Wade and Hulland, 2004).

Another way of viewing this is that the store-based retail industry may generate externalities for the growth of the e-retail industry. According to Demsetz, “[e]very cost and benefit associated with social interdependencies is a potential externality” (1967, p348). Put differently, economic actors with interdependent relations jointly produce an externality and whether it is positive or negative is a function of how it is produced and who produces it (Frischmann and Lemley, 2007).

Retail firms' behaviors have self-reinforcing effects. They may generate externalities by making e-retail-related specialized inputs and services available, forming a specialized “labor market”, and facilitating the exchanges and spillovers of information and technology (Marshall, 1920). These externalities, which originate from other firms in the same industry, are called MAR externalities (Marshall, 1890; Arrow, 1962; Romer, 1986). MAR externalities represent the positive role of specialization on growth through knowledge spillovers (Bun et al., 2007).

There is also a possibility of “inter industry knowledge spillovers”, which are referred as Jacobs (1969) externalities. In sum, the extent to which consumers can realize the benefits of e-retailing is a function of the nature of ecosystem and various externalities generated by the store-based retailing. The above leads to the following hypothesis:

H₂: Ceteris paribus, the per capita e-retail spending in an economy is positively related to per capita spending in store-based retailing.

3.3 Availability of traditional retail stores and substitution effects

The availability of substitute goods is one of the most important determinants of the elasticity of demand for a commodity under consideration (Stigler, 1966). Prior researchers have noted that product differentiation leads to a low cross-elasticity of demand between the incumbent’s brands and a potential entrant’s product (Caves and Porter, 1977). We extend this logic to argue that a high concentration of physical stores reduces the cross-elasticity of demand between the conventional and electronic channels. That is, due to potential cross-channel substitution effects, a high concentration of physical stores may work against e-retailers. This can also be explained in terms of suppressing effects, that is, the presence of a large number of physical stores is likely to reduce the attractiveness of e-retailing (Wade and Hulland, 2004). This is because a higher concentration means a shorter distance to a drive to a store and hence more convenient to shop at a physical store.

A high concentration of physical stores may also be an indication that firms may carry excess capacity. The excess capacity in the store-based retailing may discourage the entry of new e-retailing firms. Incumbent firms with unused capacity may engage in price warfare as well as against new e-retailing entrants (Caves and Porter, 1977). Our essential point here is that, in the presence of substitutes from conventional retailing, demand for products sold online tends to be price elastic.

The e-commerce literature has emphasized the role of consumer perceptions of online convenience in driving online retailing (Brynjolfsson et al., 2003; Spiller and Lohse, 1998; Szymanski and Hise, 2000). Prior researchers have also noted that the lower transaction costs offered by the Internet have led to increased orders for many book titles which were not previously available in conventional stores (Brynjolfsson et al., 2003). A study found that, in the U.S. industries, cost savings from e-commerce as a proportion of total input costs varied from 2% in for firms in the coal industry to 40% in electronic components industry (Coppel, 2000).

Regarding consumers' switch from conventional retailing to e-retailing, the reason perhaps most often cited is that e-retailing offers consumer convenience (Litan and Rivlin, 2001). Using innovation diffusion theory, convenient access to products can be framed as offering a higher degree of relative advantage of e-retailing over store-based retailing (Rogers, 1995).

Brynjolfsson and Smith (2000) found that the closest bookstore in the U.S. was about 5.4 miles for the average person. Their study indicated that to place an order for a special book from the store, a consumer needed to drive 21 minutes and spend an additional 8 minutes to park, search for the book and to find a sales person in the store and to place the order. Therefore, the consumer needed to spend 29 minutes for driving, parking and paying for the special order (cf. Brynjolfsson et al., 2003).

The line of argument developed above leads us to the suggestion that the relative convenience of e-retailing over conventional retailing also depends on the availability of physical stores. Prior researchers have suggested that well-developed and efficient traditional retailing networks (e.g., in France and Taiwan) reduce the need for e-retailing (Gibbs et al., 2003; Ho et al., 2007).

In many cases, consumers use the Internet only during the searching phase and visit physical stores to make a purchase. A survey indicated that 46% of online browsers went to make a purchase in the store (MarketWatch: Global Round-up, 2007). This is especially true for consumers living in remote areas, who lack specialty retailers and are thus likely to benefit from the e-retailing (Brynjolfsson et al., 2003).

A final issue that deserves mention relates to the importance placed on touch and feel. Consumers' preference for touch and feel has been an important factor hindering the growth of e-commerce (Kshetri, 2001). The unavailability or inaccessibility of conventional retail stores leads to a higher cost to experience the touch and feel of the products as a part of their making purchase in a conventional retail store.

In sum, a wide availability of retail stores weakens the convenience proposition offered by e-retailing. We thus hypothesize that:

H₃: Ceteris paribus, the per capita e-retail spending in an economy is negatively related to the availability of the retail stores.

3.4 Regulatory restrictions on e-retailing: Economic freedom

In considering the two broad sets of factors that we view as determining e-retail spending, we have said little about how the general parameters established by policymakers affect the diffusion of e-retailing. That is, we have yet to discuss how government policies and regulations influence the generation and use of e-retailing technologies and applications by organizations and individuals.

Policymakers play a key role in establishing the general parameters in which the e-retail industry can develop. Governments' concern about the outflow of foreign currency has been an obstacle for e-commerce growth in some countries such as China and Malaysia. These barriers

are compounded by monopoly in telecom and courier markets (Kshetri, 2001). In China, for example, when FedEx, UPS, TNT and DHL first entered, they were all required to work with the Chinese company, Sinotrans, as the exclusive agent (Yan, 1998).

Government policies and regulations influence the generation and use of e-commerce technology by organizations and individuals. For instance, Asian countries such as Hong Kong, India, Malaysia, Singapore, Taiwan, and Thailand are providing tax and other incentives for MNCs and are promoting high-tech districts. Tariff/non-tariff policies also influence the availability and price structures of IT products needed for e-retailing. Prior research indicates that higher tariffs and customs on IT products are hindering the growth of e-commerce in Latin America (Kshetri and Dholakia, 2002).

Institutional economists have provided abundant evidence to suggest that the institutional and policy environment of a country is tightly linked to economic growth (Gwartney, 2009). We extend this logic to the context of the retailing industry to suggest that countries with high economic freedom enjoy rapid growth in the development of new industry such as e-retailing, *ceteris paribus*. Gwartney (2009, p947) notes: “As transportation and communication costs have fallen substantially through time, production in regions far from sources of key inputs and markets where output will be sold is now more feasible than ever before. As a result, entrepreneurs and investors have more discretion with regard to the location of production facilities. However, trade restrictions that make it more costly to import resources and export products will significantly reduce the attractiveness of a country as a potential location for production. Thus, theory indicates that countries with lower trade restrictions will have higher private investment rates than those that are relatively closed”.

Economies worldwide also vary widely in terms of the ease and speed with which an e-retailing business can be started. For instance, according to the World Bank's Doing Business Survey, to start a new business, 16 procedures are to be completed in Venezuela, which take 141 days (The World Bank Group, 2009). In New Zealand, on the other hand, starting a new business requires only one procedure, which can be completed in a day. The survey also found that costs to start a new business as a proportion of per capita income vary from 0.4% in Canada to 66% in India (The World Bank Group, 2009). This suggests that global e-retailers, such as amazon.com and Dell Computers, face higher levels of barriers in Venezuela than in New Zealand if they like to enter these countries. Put differently, for a given level of investment in e-retail-enabling technologies such as broadband, some government policies have potential e-retailing-enhancing effects whereas others have e-retailing-suppressing effects (Wade and Hulland, 2004). Thus, we hypothesize that:

H₄: Ceteris paribus, the per capita e-retail spending in an economy is positively related to economic freedom.

4. Data Modeling and Analysis

This section describes the data and the statistical analysis we employed in the empirical investigation. First, we discuss the sources of the data and how the variables were measured. We then discuss the explanatory and control variables. This section ends with a discussion of the statistical analysis that was used to examine the effect of the economic and institutional variables on the e-retail spending.

Data on GDP, retail sites, store-based retail spending, e-retail spending, population, population density and broadband Internet subscribers were obtained from Euromonitor. There are five major constraints related to the use of international secondary data: accuracy, age,

reliability, lumping and comparability (Kotabe and Helsen, 2001). Euromonitor largely addresses these constraints (Kotabe, 2002). Data are compiled from various “reputable sources” and measures are taken to make them internationally comparable (Kotabe, 2002: 173). Regarding comparability, it is also important to note that this constraint is mainly a consequence of a lack of common and shared understanding of a concept (e.g., social capital) across countries (Harper, 2002). This problem is compounded by different languages used in the surveys for measuring the concepts. Since the data used in this paper represent actions rather than attitude, feeling or intention and have straightforward operationalizations, international comparability doesn’t seem to be a problem. Kotabe (2002) observes: “Usually, the measurement quality of data collected from reputable data sources such *WMDS* [Euromonitor’s World marketing data and statistics] do not get challenged in the blind review process” (p. 174). Note that Euromonitor data have been used in past studies (e.g., Coulter et al., 2003; Ganesh, 1998; Kshetri et al., 2007).

Data on economic freedom were obtained from the Heritage Foundation. As is the case with Euromonitor data, researchers have successfully used the Heritage Foundation’s data (Gwartney, 2009).

4.1 Dependent and explanatory variables

Our dependent variable is per capita spending in e-retailing (PCERetail) in US Dollars. Table 1 presents PCERetail data for the economies used in our analysis. A complete listing of the explanatory variables used in this study, together with their description, is summarized in Table 3. Tables 4a and 4b report descriptive statistics for all variables for 1999 and 2008. Similarly, Tables 5a and 5b present the correlation matrices of the independent and dependent variables for 1999 and 2008.

Table 3: Dependent, explanatory and control variables used in this study.

<i>Variable</i>	<i>Explanation</i>	<i>Remarks</i>
PCERetail	Per capita spending in e-retailing	This variable is related to “Internet retailing” in Euromonitor’s classification, which is one of the four categories listed under non-store retailing, other three being direct selling, homeshopping and vending. It is measured by the sales of “consumer goods to the general public via the Internet”. It also includes mobile retailing (m-commerce) conducted via wireless devices connected to the Internet. A sales transaction is attributed to the country of the consumer’s location rather than the retailer’s.
PKBroad	Broadband Internet subscribers per 1000 people.	Euromonitor defines a broadband Internet subscriber as “someone who pays for high-speed access to the public Internet (a TCP/IP connection)”. High-speed access is 256 kbit/s or greater, as the sum of the capacity in both directions.
PCSRetail	Per capita spending on store-based retailing (US\$)	Store-based retail spending is the sum of sales by grocery retailers and non-grocery retailers to the general public. It may be for personal or household consumption takes place in retail outlets or market stalls.
PKRetailsites	Retail sites per 1000 persons	It measures the concentration of the grocery and non-grocery retail stores.
ECFR	Economic Freedom (Score)	The Wall Street Journal and The Heritage Foundation (http://www.heritage.org/) have tracked the economic freedom of the world’s 183 countries. The Index covers ten components of economic freedom, which according to Heritage Foundation, are based on Adam Smith’s theories about liberty, prosperity and economic freedom and measure economic success (The Heritage Foundation 2009). Each component is assigned a score in each component (in a 0 to 100 a scale, 100 representing the maximum freedom). The overall economic freedom for an economy is the average of the scores for the ten components: Business Freedom, Trade Freedom, Fiscal Freedom, Government Spending, Monetary Freedom, Investment Freedom, Financial Freedom, Property rights, Freedom from Corruption and Labor Freedom (heritage.org 2010).
GDPPC-PPP	Gross domestic product (GDP) per capita at purchasing power parity.	This variable was excluded from the final analyses due to multi-collinearity issues.

Table 4a: Descriptive statistics for 1999 data (N= 43).

	Mean	Minimum	Maximum	SD
PCERetail (US\$)	11.42	0	71.00	15.56
PKBroad	3.58	0	46.48	8.91
PCSretail (US\$)	2977	102.50	8283	2239
PKRetailsites	7.66	1.55	16.60	3.22
ECFR	65.37	46.23	88.51	9.14
PCGDPPPP (US\$)	16960	1395	37296	9815

Table 4b: Descriptive statistics for 2008 data (N= 43).

	Mean	Minimum	Maximum	SD
PCEretail (US\$)	109.43	0.40	510.00	119.71
PKBroad	153.26	0.03	373.59	120.78
PCSretail (US\$)	4930	201.89	11691	3397
PKRetailsites	7.77	2.35	18.08	3.71
ECFR	67.86	44.71	89.66	10.04
PCGDPPPP (US\$)	26289	2822	53508	13666

Table 5a: Correlation matrix for 1999 data.

	PKRetailsites	ECFR	PCGDPPPP	PCSretail	PKBroad
PCEretail	-.24	0.32*	0.63***	.64***	0.31*
PKRetailsites		-0.09	-0.08	-0.09	-0.16+
ECFR			0.06***	0.049**	0.18
PCGDPPPP				0.89***	0.33*
PCSretail					0.29+

Table 5b: Correlation matrix for 2008 data.

	PKRetailsites	ECFR	PCGDPPPP	PCSretail	PKBroad
PCEretail	-0.35*	0.53**	0.66***	0.66***	0.44**
PKRetailsites		-0.20	-0.24	-0.24	-0.14
ECFR			0.77***	0.63***	0.53**
PCGDPPPP				0.85***	0.66***
PCSretail					0.66***

⁺Significant at 0.1 level, *Significant at 0.05 level, ** Significant at 0.01 level, ***Significant at 0.001 level

4.2 Control variable: per capita GDP

Oxley and Yeung (2001), among other researchers, have suggested that empirical models estimating cross-national variation in e-commerce activities need to control for per capita GDP. According to these researchers, e-commerce activities as well as explanatory variables related to economic and institutional factors are likely to have significant correlations with the level of economic development.

Per capita income is one of the important factors influencing “demand and cost conditions” of a country’s involvement in technological innovations such as e-retailing (Beise, 2001). Dekimpe et al. (2000) argue that high per capita income allows potential adopters to

afford greater economic sacrifice to adopt an innovation. For instance, consumers' ownership of credit cards facilitates e-retailing. In an international context, it can be argued that an economy's standard of living and the level of economic development influence the adoption timing as well as diffusion speed of technological innovations such as e-retailing (Antonelli, 1993; Gatignon and Robertson, 1985; Dekimpe et al., 2000; Gruber and Verboven, 2001; Kshetri, 2001; Retail Merchandiser, 2007). We thus started our analysis by controlling for the income effect.

4.3 Statistical analysis

As noted earlier, only by confronting retailing theories with data for a long period of time can such theories be put to a test that is more rigorous than is feasible with cross-sectional data. We thus employed time series cross sectional (TSCS) models linear in parameters using annual data for 2003-2007. TSCS models are designed to overcome the limitations of usual linear models. When pooling data one or more assumptions of the usual linear model may be violated. Fomby et al. (1984, p337) point out several such possibilities. First, the error terms in a pooled model may be "heteroskedastic, autocorrelated and may exhibit contemporaneous correlation" which makes a generalized least square technique inappropriate. Second, the parameters of the data generating process may differ from observation to observation. The reactions of different cross sections may be different to changes in explanatory variables, and the reactions may also change over time. TSCS models allow for differences in behavior over cross sectional units as well as the differences in behavior over time for a given cross section. In sum, in addition to a gain in degrees of freedom (DF) (Bass and Wittink, 1975), TSCS models overcome limitations of usual linear models and are consistent with the way the data are generated (Fomby et al., 1984).

We employed the following TSCS model:

$$PCIR_{it} = \beta_{1it} + \sum_{k=2}^K \beta_{kit} X_{kit} + \varepsilon_{it} \quad (1),$$

where, $PCIR_{it}$ is the per capita spending on e-retailing and β_{1it} is the dummy variable for the i^{th} country for the t^{th} time period and β_{kit} ($k \geq 2$) are the slopes. X_{kit} ($k \geq 2$) is the value of the predictor X_k for the i^{th} country in time t .

A key concern with TSCS models is the selection of the most efficient estimation procedure and associated testing of hypotheses about the parameters. Several factors need to be taken into consideration in selecting the appropriate model. The first is the choice between fixed and random effects models. For the fixed effect (or dummy variable) model, the intercept term β_{1it} in (1) can be written as

$$\beta_{1it} = \alpha_i + \tau_t \quad (2),$$

where α_i are the country “dummies” and τ_t are the time “dummies”. The dummy variable model, however, eliminates a major portion of the variation among explained as well as explanatory variables if the between-country and between-time period variation is large (Maddala, 1971). Additional problems include a loss in a substantial number of degrees of freedom and a lack of meaningful interpretation of the dummy variables (Maddala, 1971).

These problems can be overcome by treating α_i and τ_t as random (Bass and Wittink, 1975) in which case only two parameters, the mean and the variance of the α 's (and similarly for τ 's), are estimated instead of $N+T$ parameters in dummy variable models (N = No. of cross-sections and T = No. of time periods). The procedure of treating α_i and τ_t as random can be rationalized by arguing that the dummy variables represent ignorance like ε_{it} . Maddala (1971) argues that this “specific ignorance” can be treated in the same manner as ε_{it} .

Then the residual can be written as:

$$u_{it} = \alpha_i + \tau_t + \varepsilon_{it} \quad (3).$$

Then,

$$PCIRit = \sum_{k=2}^K \beta_{kit} X_{kit} + \alpha_i + \tau_t + \varepsilon_{it} \quad (4).$$

In TSCS models, two considerations, *logical and statistical*, may determine the choice of specification—fixed vs. random (Hausman, 1978). The *logical* consideration is whether β_{lit} can be considered random and drawn from an independently and identically distributed (IID) distribution (Hausman, 1978). The statistical consideration is whether β_{lit} 's satisfy “di Finnetti’s exchangeability criterion” (p. 1263), a necessary and sufficient condition for random sampling. If these conditions are satisfied, then random model can be more appropriate than fixed model. To empirically test the statistical consideration, we estimated the fixed effect model¹ for the cross-sections for which “complete” data for the period under consideration were available. Then we calculated the correlation between the country specific fixed effects and time specific fixed effects with other country specific factors or regressors (Table 6). As table 6 indicates, most of the Pearsonian coefficients are insignificant, which makes it clear that random effect TSCS models are more appropriate for the given data set than fixed effect models.

Table 6: Estimation of Pearsonian correlation coefficients of the regressors with the country specific and time specific fixed effects.

Variable	Pearsonian correlation coefficient with country specific fixed effect (p-value)	Pearsonian correlation coefficient with time specific fixed effect (p-value)
PCEretail	.189(.224)	-.793**(.006)
PKBroad	.294(.056)	-.794**(.006)
PCSretail	.130(.405)	-.843**(.002)
PKRetailsites	-.055(.726)	-.829**(.003)
ECFR	.278(.071)	.450(.192)

PCGDPPPP	.190(.222)	-.767**(.010)
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Upon establishing the appropriateness of the random effect TSCS models over fixed effect ones, the next step would be to select the most appropriate random effect model. In the pooled data on Internet diffusion, it is reasonable to expect heteroskedasticity [i.e. $E(u_{it}^2) = \sigma_{ii}$], contemporaneous correlation or spatial heterogeneity [i.e. $E(u_{it}u_{jt}) = \sigma_{ij}$] (Anselin, 1987), and autoregression [i.e. $u_{it} = \rho_i u_{i,t-1} + e_{it}$]. Among the three most commonly used estimation procedures for random effect TSCS models—Fuller-Battese, Da Silva and Parks—the Fuller-Battese (Fuller and Battese, 1974) takes only heteroskedasticity into account while Da Silva (1975) considers heteroskedasticity and autoregression. Parks (1967) method, on the other hand, takes heteroskedasticity, autoregression as well as contemporaneous correlation into account and hence appears to be the most appropriate method to study the multi-country diffusion process. We used Parks' (1967) autoregressive model to estimate the parameters of (4).

For cross sectional analysis of 1999 and 2008 data, we supplemented the TSCS models with ordinary least squares (OLS) estimates for 1999 and 2008, which are the beginning and the ending years for our panel data.

4.4 Dealing with multicollinearity

A common approach in assessing the extent of multicollinearity problem is the calculation of variance inflation factors (VIFs). A commonly accepted rule of thumb suggests that if a VIF is greater than 10, it is often interpreted as an indication of a multicollinearity problem that is worthy of further study (Myers, 1990; Neter, Wasserman and Kutner, 1985). Heiberger and Holland (2004) suggest a slightly more conservative rule which requires that all the VIFs be less than or equal to 5. If one or more VIFs exceed 5, the iterative procedure involves eliminating predictors one at a time starting with the predictor that corresponds to the highest

VIF. A regression model is then estimated with the remaining predictors and the above process is repeated until all VIFs ≤ 5 (Heiberger and Holland, 2004).

In order to focus attention upon the multicollinearity problem, the ordinary least squares (OLS) estimates are obtained for 1999 and 2008. The results in Table 7 indicate that a problem of multicollinearity arises when the control variable, GDP is included in the regression models for both years. We thus eliminated per capita GDP from the final analysis due to multicollinearity.

Table 7: VIF values for 1999 and 2008 data (Dependent Variable: PCERetail)

Predictors	Year 1999		Year 2008	
	Iteration 1	Iteration 2	Iteration 1	Iteration 2
PKBroad	1.157	1.120	1.893	1.841
PCSretail	5.240	1.406	3.812	2.251
PKRetailsites	1.035	1.033	1.072	1.070
ECFR	1.629	1.332	2.658	1.734
PCGDPPPP	6.467		5.718	

4.5 Analysis of Results

The results from the TSCS regression analyses are presented in Table 8. The model in column 1 includes all the explanatory variables. We also estimated models that included only one explanatory variable at a time (columns 2-5). It is apparent from a comparison of the results in Tables 8, 9a and 9b that TSCS models show more significant results than OLS models. One limitation of the cross sectional OLS estimates is that even fairly large differences will fail to reach significance due to the relatively small sample size.

Table 8: TSCS regression results (1999-2008) (Park's Method).

	DV= PCERetail	DV= PCERetail	DV= PCERetail	DV= PCERetail	DV= PCERetail
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Intercept	-6.95 (1.14)	77.91 (52.64)***	73.63 (36.76)***	-40.76 (111.69)**	15.89 (13.19)***

				*	
PKBroad	0.26 (31.98)***				0.40 (33.18)***
PCSretail	0.014 (40.39)***			0.02 (67.29)***	
PKRetailsites	-1.6 (4.18)***	-5.5 (71.02)***			
ECFR	-0.03 (0.86)		1.47 (48.67)***		
N	43	43	43	43	43
T	10	10	10	10	10
DFE	425	428	428	428	428

The numbers in parentheses represent t-values.

+Significant at 0.1 level, *Significant at 0.05 level, ** Significant at 0.01 level, ***Significant at 0.001 level

It is also important to note that conventional measures of R^2 are inappropriate for TSCS models (SAS Institute 1999: 1136). Thus, we do not report R^2 values for the TSCS models.

Table 9a: OLS regression results (1999)

	DV= PCEretail	DV= PCEretail	DV= PCEretail	DV= PCEretail	DV= PCEretail
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Intercept	4.76(.311)	20.35 (3.35)*	-25.0 (1.5)	-1.8(.59)	9.47 (3.84)***
PKBroad	.195 (.879)				.545 (2.1)*
PCSretail	0.004 (4.15)***			0.004 (5.3)***	
PKRetailsites	-.800 (1.36)	-1.16 (1.6)			
ECFR	-0.002 (.008)		.557 (2.22)*		
N	43	43	43	43	43
R^2	.452	.058	.107	.409	0.098
ADJ. R^2	.395	.035	.086	.395	.076
F	7.85***	2.54	4.93*	28.23***	4.43*

Table 9b: OLS regression results (2008)

	DV= PCEretail	DV= PCEretail	DV= PCEretail	DV= PCEretail	DV= PCEretail
	Col. 1	Col. 2	Col. 3	Col. 4	Col. 5
Intercept	-62.91(.558)	196.8(4.8)***	-318.34 (2.94)**	-9.6(.403)	42.45(1.57)
Broadpk	-0.46 (.303)				.437(3.15)**
PCSretail	0.20 (3.4)*			.024(6.02)** *	
PKRetailsites	-5.91 (1.57)	-11.24 (2.4)*			
ECFR	1.9 (1.1)		6.3 (4.0)***		
N	43				
R^2	.519	.122	.281	.470	.194
ADJ. R^2	.468	.100	.263	.457	.175
F	10.23***	5.68*	16.00***	36.31***	9.9**

Note: The numbers in parentheses represent t-values.

⁺Significant at 0.1 level, *Significant at 0.05 level, ** Significant at 0.01 level, ***Significant at 0.001 level

The estimation results provided in Table 8 support hypotheses 1, 2 and 3. This means that each of the three variables---broadband penetration, concentration of conventional retail stores and store-based retail spending-- has a significant effect on e-retail spending. These results are still valid when controlled for the effects of other variables. The TSCS (see Table 8) as well as the OLS estimates (Table 9a and 9b) indicate that based on the t-values, the most important variable in determining e-retail spending is the per capita spending on store-based retailing (PCSretail). This means that e-retailing is likely to build on the existing store-based retail culture and consumers' propensity to spend on store-based retail activities.

This PKBroad variable has insignificant effect on e-retail spending in the OLS regression results (Table 9a and 9b). Considering column 1 in Table 8, we note, however, that PKBroad has a significant effect on e-retail spending in the TSCS estimates. Researchers have suggested that the development and availability of infrastructure needed for efficient marketing an international marketer's country selection decision (Manrai and Manrai, 2001). Instead of physical infrastructures such as road, telecommunications infrastructures play an important role in the development of the e-retail industry. Therefore, in the present study, we extended prior observations related to marketing in the context of the online world. The widespread use of low-cost broadband services is a leading reason for the rapid growth of the global e-retailing industry (MarketWatch: Global Round-up, 2007).

Regarding the effects of economic freedom (ECFR), a comparison of results in Col. 5 with those in Col. 1 (Table 8) indicates that, when taken alone this variable has a significant effect on e-retail spending. However, when all the explanatory variables are included in the

model, its effect on e-retail spending is insignificant. Thus, there are mixed results regarding the effects of economic freedom on the development of the e-retailing industry. In addition, the OLS results indicate that ECFR has become the second most important predictor, only behind PCSretail for 1999 ($t = 2.22$, $p < 0.05$) as well as for 2008 ($t = 4.0$, $p < 0.001$). A similar point can be made regarding its ability to explain the cross-national variability in e-retailing based on the values of the coefficient of determination (R^2). On the whole, this evidence, both anecdotal and from our data, appears to suggest that economic freedom is an important driver of e-retail activities.

The variable retail sites per 1000 persons (PKRetailsites) seems to be one of the least important variables, especially in the OLS regression results. Nonetheless, the TSCS results have shown that this factor affects e-retail spending.

5. Concluding Remarks

The scholarly literature has at times lamented that most of the e-commerce studies are limited to a single country (Zhu and Kraemer, 2005) and most have focused primarily on the U.S. (Dedrick et al., 2003). Whereas Srivivasan et al. (2013), after an extensive survey of the research literature, had proposed a conceptual model for e-retailing, it was limited to the technology dimensions and did not address the macro-economic considerations. While other recent studies (see Table 2) have attempted to address this issue, none has done so in a way that served the theoretical and empirical objectives of this study. Moreover, existing cross-national e-commerce studies have focused on a small group of countries. In this regard, this study is the largest and most inclusive study on cross-national e-commerce industry.

A sample consisting of developed, developing, and newly industrialized countries in e-commerce research would help strengthen the generalizability of findings (Zhu and Kraemer, 2005). The sample in our study has a higher degree of representativeness than most cross-national e-commerce studies, which is likely to lead to a high degree of generalizability.

The insights developed in this article are important for several reasons. First, the framework presented in this paper also has implications for management practices and public policy. At this point, it is relevant to note that firms engage in continuous experimentation in the marketplace with their “changing mix of technological and market conduct” (Antonelli, 2009; p. 625). This paper’s findings may provide guidance in firms’ e-retail “experiment”.

From the managerial standpoint, the four factors analyzed in this paper are not equally important. A well-developed store-based retail market is the strongest predictor of the e-retail market. As discussed earlier, store-based retail activities in a country are likely to generate various externalities needed for the e-retail industry. The results also indicate that global e-retailers must give major attention to economies with high levels of broadband penetration and high levels of economic freedom in their country selection decision. At the same time, countries with heavy concentration of physical stores are less attractive for e-retailers. Overall, however, a country with a well-developed store-based retailing is likely to be more attractive e-retail market compared to one with a high level of broadband development.

The predictors, however, may not change at the same rate. For instance, broadband penetration may change more rapidly compared to other factors discussed in this paper. As broadband becomes more ubiquitous, e-retailers need to pay more attention on market, industry and policy related variables. Moreover governments in some countries may have special

initiatives to address some of the issues, which may increase their e-retail attractiveness. For instance, Chinese government is taking major initiatives to develop a consumer culture.

In order to make a progress towards a fully developed digital economy, policy makers need to understand the drivers of e-retailing. Obviously, special attention needs to be given to progress in developing broadband infrastructure, improving economic freedom and introducing business friendly policies, and promoting consumption culture.

Especially governments in many developing countries that perform relatively poorly in most of the areas discussed above need to do a careful assessment of what is important as well as what is practical and feasible to change. An example from China will serve to illustrate this point. China's state strategies toward the Internet have been to balance economic modernization and political control (Kalathil, 2003). The Chinese government undoubtedly would like to see its citizens use the Internet for online shopping activities. Currently it is working to improve at least two of the factors discussed above—high broadband penetration and increased consumer spending. The second variable may warrant elaboration. For instance, a low retail spending has been a concern in China (Roach, 2009). As noted earlier, in light of the global financial crisis (GFC), the Chinese government has been taking various initiatives to develop a consumer culture. For instance, many city governments distributed spending vouchers to residents and in some cities, civil servants receive consumer vouchers for up to 10 percent of their salaries (Vembu, 2009). The findings of this paper suggest that the efforts to develop a consumer culture and increase consumers' propensity to spend on retail activities in general are no less important than the broadband development in terms of the contribution to the development of the e-retail industry.

Several limitations of this research must be recognized in a balanced discussion of its findings. First, this study does not include many economies that are at the bottom-most of the global economic pyramid as data were not available for these economies. One reason behind the data unavailability is that the e-retailing industry is still at a nascent stage of development in these economies. An additional limitation of this research is that we did not include variables related to culture. Finally, techniques such as structural equation modeling (SEM) and partial least squares (PLS) could not be employed to test complex theoretical structures due to a lack of a sufficient number of indicators per factor (Barclay et al., 1995).

Both the contributions and limitations of this research merit attention and afford directions for future research. Further inquiry is needed to investigate whether the findings of this paper can be extended to economies that could not be included. These are mainly low-income countries that are characterized by different economic and institutional conditions. When e-commerce data on these economies become available, the above hypotheses need to be tested.

Future research based on the present framework can be extended to other e-commerce areas. For instance, economic and institutional factors driving cross-national variation in Internet advertising might be worthwhile target of study.

Future research might also examine how cultural factors are related to international variation in e-retailing. Prior research indicates that cultural factors such as individualism are linked with consumer behavior in the virtual world channels (Barnes and Pressey, 2011; Meng, and Mummalaneni, 2011). Unlike the explanatory variables used in this paper, however, longitudinal data related to relevant cultural variables may not exist. However, even a cross-sectional study using some measures of culture as independent variables would help to understand international variation in e-retail spending.

Data from the Economist Intelligence Unit supports the notion that broadband Internet access and mobile penetration are two important determinants of economies' "e-readiness" (ebusinessforum.com, 2005). This paper focused on the effects of broadband Internet access on e-retail activities. Technological advances have increased the pervasiveness of mobile devices in e-shopping activities. This is thus a promising perspective and one which should be pursued in future research.

One issue that was raised in this article but not fully developed was the price of products in the electronic channel. Prior researchers have suggested that the price of the commodity relative to consumers' income, as well as the position of the price with respect to the demand curve influence the elasticity of demand (Stigler, 1966). In this regard, another intriguing avenue for future research is to examine how price differential of products in the electronic and conventional channels explain the variation in e-retail spending across markets.

In closing, this paper has provided insights into our understanding of how the contexts provided by regulatory, market, industry and technological factors affect the development of the e-retail market. We have used economic theory of complementarities as an overarching theory, which encompasses and includes other theories employed in the paper. Development of the e-retail market is tightly linked to the existence of a strong ecosystem of the availability and concentration of traditional retail store, consumers' propensity to spend on store-based retail activities, technologies facilitating e-retailing and government regulations affecting the value chain of the retail sector.

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Notes:

- ¹Even if random effects specification is found more appropriate on logical ground, one may still estimate fixed effects models. The fixed effect estimators are based on a particular sample which treats them as fixed in the sample (Hausman 1978).
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